IN THE CLAIMS

The following is a complete listing of the claims, and replaces all earlier versions and listings.

1. (currently amended) A method for creating a computer hologram, which is supposed to be observed in a lighting environment of the real world where a multiple of light sources exist, by forming interference fringes on a predetermined recording surface ~~(20)~~ by a computer-aided operation, said method ~~comprises~~ comprising the steps of:

defining a predetermined original image ~~(10)~~ in a three-dimensional coordinate system, a recording surface ~~(20)~~ placed in the coordinate system for recording the original image, and a reference light ~~(R)~~ to be irradiated onto the recording surface;

defining a large number of calculation points ~~(Q(x, y))~~ on the recording surface ~~(20)~~, and calculating, in terms of the individual calculation points, intensity of an interference wave formed by an object light ~~(O1 to ON)~~ emitted from a light source ~~(P1 to PN)~~ defined on the original image ~~(10)~~ and the reference light ~~(R)~~;

defining a plurality of types of binary patterns ~~(D0 to D6)~~ each defined by dividing a unit area having a fixed form and size into a first area having a first pixel value and a second area having a second pixel value by changing an occupancy ratio of the first area relative to the unit area;

allocating, at positions of the respective calculation points ~~(Q(x, y))~~, binary patterns ~~(D0 to D6)~~ having occupancy ratios corresponding to interference wave intensities in terms of the respective calculation points, respectively; and

creating physical fringes on a medium ~~(40)~~ based on a binary image formed from an

assembly of the binary patterns ~~(D0 to D6)~~ allocated onto the recording surface, ~~(20)~~;

wherein a rectangle is used as the unit area, and the binary pattern is formed by arranging the first area formed of a rectangle having a vertical width equal to a vertical width of the unit area and having a horizontal width according to a predetermined occupancy ratio at an approximately center position with respect to a horizontal width of the unit area and providing a remaining part as the second area, and

wherein a horizontal pitch of the calculation points ~~(Q(x, y))~~ defined on the recording surface ~~(20)~~ is set equal to or less than a minimum wavelength of a visible light.

2. (canceled)

3. (currently amended) The method for creating a computer hologram according to claim ~~2~~ 1,

wherein physical binary patterns are formed by beam scanning using a drawing apparatus with a predetermined resolution, horizontal width sizes of the rectangles forming the first areas of the individual binary patterns are set to be integral multiples of a predetermined unit size L provided in advance within a range where drawing by the drawing apparatus is possible.

4. (original) The method for creating a computer hologram according to claim 3,

wherein the horizontal width sizes of the rectangles forming the unit areas are set so as to be n times as great as the unit size L (n is an integer), (n+1) types of binary patterns such as to have horizontal width sizes of the rectangles forming the first areas 0 times, 1 time, 2 times,

... n times as great as the unit size are prepared, and the binary patterns are allocated to interference wave intensities sectioned in (n+1) levels in a corresponding manner, respectively, and where a minimum drawing size determined based on drawing resolution of the drawing apparatus is provided as h, a horizontal pitch of the calculation points is set so as to be equal to or less than the minimum wavelength of a visible light and equal to or more than h × n.

5. (currently amended) The method for creating a computer hologram according to claim ~~2~~ 1,

wherein rectangles each having a vertical width equal to a vertical pitch of the calculation points and a horizontal width equal to a horizontal pitch of the calculation points are used as the unit areas, reference points common to all the unit areas are provided, the individual binary patterns are allocated so that the respective reference points are arranged on the respective calculation points so that the binary patterns are allocated across an entire surface of the recording surface, and the vertical pitch and the horizontal pitch of the calculation points are both set so as to be equal to or less than the minimum wavelength of a visible light.

6. (original) The method for creating a computer hologram according to claim 1,

wherein the minimum wavelength of a visible light is provided as 400nm.

7. (currently amended) A computer-readable storage medium storing a program to make a computer execute processes until a creating step of a binary image in the method for creating a computer hologram according to claim 1 ~~or a computer-readable recording medium~~

~~containing said program~~.

8. (original) A computer hologram medium on which a computer hologram created by the method according to claim 1 is recorded.

9. (currently amended) A method for creating a computer hologram which is supposed to be observed in a lighting environment of the real world where a multiple of light sources exist, by forming interference fringes on a predetermined recording surface by a computer-aided operation, said method comprises the steps of:

defining a predetermined original image ~~(10)~~ in a three-dimensional coordinate system, and a recording surface ~~(20)~~ placed in said coordinate system for recording the original image;

defining a large number of calculation points ~~(Q(x, y))~~ on the recording surface ~~(20)~~, and calculating, in terms of the individual calculation points, intensity and phase of an interference wave formed by an object light ~~(O1 to ON)~~ emitted from a light source ~~(P1 to PN)~~ defined on the original image ~~(10)~~;

defining a plurality of types of binary patterns ~~(D0 to D6)~~ each defined by dividing a unit area having a fixed form and size into a first area having a first pixel value and a second area having a second pixel value by changing an occupancy ratio of the first area relative to the unit area;

allocating, at positions of the respective calculation points ~~(Q(x, y))~~, three-dimensional cells with the two-dimensional binary patterns having occupancy ratios corresponding to interference wave intensities in terms of the respective calculation points, respectively, and

three-dimensional structures capable of phase modulations corresponding to interference wave phases in terms of the respective calculation points, respectively; and

creating a physical hologram recording medium formed from an assembly of the three-dimensional cells allocated onto the recording surface, ~~(20);~~

wherein a rectangle is used as the unit area, and the binary pattern is formed by arranging the first area formed of a rectangle having a vertical width equal to a vertical width of the unit area and having a horizontal width according to a predetermined occupancy ratio at an approximately center position with respect to a horizontal width of the unit area and providing a remaining part as the second area, and

wherein a horizontal pitch of the calculation points ~~(Q(x, y))~~ defined on the recording surface ~~(20)~~ is set equal to or less than a minimum wavelength of a visible light.

10. (canceled)

11. (currently amended) The method for creating a computer hologram according to claim ~~10~~ 9,

wherein physical binary patterns are formed by beam scanning using a drawing apparatus with a predetermined resolution, horizontal width sizes of the rectangles forming the first areas of the individual binary patterns are set to be integral multiples of a predetermined unit size L provided in advance within a range where drawing by the drawing apparatus is possible.

12. (original) The method for creating a computer hologram according to claim 11,

wherein the horizontal width sizes of the rectangles forming the unit areas are set so as to be n times as great as the unit size L (n is an integer), (n+1) types of binary patterns such as to have horizontal width sizes of the rectangles forming the first areas 0 times, 1 time, 2 times, ... n times as great as the unit size are prepared, and the binary patterns are allocated to interference wave intensities sectioned in (n+1) levels in a corresponding manner, respectively, and where a minimum drawing size determined based on drawing resolution of the drawing apparatus is provided as h, a horizontal pitch of the calculation points is set so as to be equal to or less than the minimum wavelength of a visible light and equal to or more than $h \times n$.

13. (currently amended) The method for creating a computer hologram according to claim ~~10~~ 9,

wherein rectangles each having a vertical width equal to a vertical pitch of the calculation points and a horizontal width equal to a horizontal pitch of the calculation points are used as the unit areas, reference points common to all the unit areas are provided, the individual binary patterns are allocated so that the respective reference points are arranged on the respective calculation points so that the binary patterns are allocated across an entire surface of the recording surface, and the vertical pitch and the horizontal pitch of the calculation points are both set so as to be equal to or less than the minimum wavelength of a visible light.

14. (original) The method for creating a computer hologram according to claim 9,

wherein the minimum wavelength of a visible light is provided as 400nm.

15. (currently amended) A computer-readable ~~recording~~ storage medium ~~containing~~ storing a program to make a computer execute processes until a creating step of a binary image in the method for creating a computer hologram according to claim 9.

16. (original) A computer hologram medium on which a computer hologram created by the method according to claim 9 is recorded.

17. (currently amended) A computer hologram medium ~~on~~ which is supposed to be observed in a lighting environment of the real world where a multiple of light sources exist, on the medium a three-dimensional original image being ~~is~~ recorded as interference fringes that form a convex and concave structure,

wherein a large number of unit areas are defined on the medium, the respective unit areas on the medium are each divided into a first area and a second area, the first area and the second area have a relationship that one forms a convex portion, and the other, a concave portion, interference wave intensity at a position of each unit area is expressed by an occupancy ratio of the first area relative to the unit area, and the respective unit areas are arrayed horizontally and vertically so as to form a two-dimensional array on the medium, and ~~at a pitch of equal or less than 400nm~~

wherein both of a horizontal pitch and a vertical pitch of the unit areas are set equal to or less than 400nm.

18. (new) A method for creating a computer hologram which is supposed to be observed in a lighting environment of the real world where a multiple of light sources exist, by forming

interference fringes on a predetermined recording surface by a computer-aided operation, said method comprising the steps of:

defining a predetermined original image in a three-dimensional coordinate system, a recording surface placed in said coordinate system for recording the original image, and a reference light to be irradiated onto the recording surface;

defining a large number of calculation points on the recording surface arrayed horizontally and vertically so as to form a two-dimensional array, and calculating, in terms of the individual calculation points, intensity of an interference wave formed by an object light emitted from a light source defined on the original image and the reference light;

defining a plurality of types of binary patterns each defined by dividing a unit area having a fixed form and size into a first area having a first pixel value and a second area having a second pixel value by changing an occupancy ratio of the first area relative to the unit area;

allocating, at positions of the respective calculation points, binary patterns having occupancy ratios corresponding to interference wave intensities in terms of the respective calculation points, respectively; and

creating physical fringes on a medium based on a binary image formed from an assembly of the binary patterns allocated onto the recording surface,

wherein both of a horizontal pitch and a vertical pitch of the calculation points defined on the recording surface are set equal to or less than a minimum wavelength of a visible light.

19. (new) The method for creating a computer hologram according to claim 18,

wherein the minimum wavelength of a visible light is provided as 400nm.

20. (new) A computer-readable storage medium storing a program to make a computer execute processes until a creating step of a binary image in the method for creating a computer hologram according to claim 18.

21. (new) A computer hologram medium on which a computer hologram created by the method according to claim 18 is recorded.

22. (new) A method for creating a computer hologram which is supposed to be observed in a lighting environment of the real world where a multiple of light sources exist, by forming interference fringes on a predetermined recording surface by a computer-aided operation, said method comprising the steps of:

defining a predetermined original image in a three-dimensional coordinate system, and a recording surface placed in said coordinate system for recording the original image;

defining a large number of calculation points on the recording surface arrayed horizontally and vertically so as to form a two-dimensional array, and calculating, in terms of the individual calculation points, intensity and phase of an interference wave formed by an object light emitted from a light source defined on the original image;

defining a plurality of types of binary patterns each defined by dividing a unit area having a fixed form and size into a first area having a first pixel value and a second area having a second pixel value by changing an occupancy ratio of the first area relative to the unit area;

allocating, at positions of the respective calculation points, three-dimensional cells with the two-dimensional binary patterns having occupancy ratios corresponding to interference wave intensities in terms of the respective calculation points, respectively, and

three-dimensional structures capable of phase modulations corresponding to interference wave phases in terms of the respective calculation points, respectively; and

creating a physical hologram recording medium formed from an assembly of the three-dimensional cells allocated onto the recording surface;

wherein both of a horizontal pitch and a vertical pitch of the calculation points defined on the recording surface are set equal to or less than a minimum wavelength of a visible light.

23. (new) The method for creating a computer hologram according to claim 22,

wherein the minimum wavelength of a visible light is provided as 400nm.

24. (new) A computer-readable storage medium storing a program to make a computer execute processes until a creating step of a binary image in the method for creating a computer hologram according to claim 22.

25. (new) A computer hologram medium on which a computer hologram created by the method according to claim 22 is recorded.